

NON-PUBLIC?: N
ACCESSION #: 9208310318
LICENSEE EVENT REPORT (LER)

FACILITY NAME: McGuire Nuclear Station, Unit 2 PAGE: 1 OF 6

DOCKET NUMBER: 05000370

TITLE: Unit 2 Manual Reactor Trip resulting From Possible Design,
Manufacturing, Construction/Installation Deficiency
EVENT DATE: 09/25/91 LER #: 91-10-1 REPORT DATE: 10/25/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Alan R. Sipe, Chairman, McGuire TELEPHONE: (704) 875-4183
Safety Review Group

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

A Unit 2 Reactor Trip was manually initiated at 1450:50 on September 25, 1991. Prior to the event, Unit 2 was operating in Mode 1 (Power Operation) at 100 percent power. The trip was manually initiated by Operations Control Room personnel upon receipt of alarm panel 2AD-4, annunciator C-4 (Steam Generator D flow mismatch low CF flow). The annunciation resulted from Main Feedwater valve 2CF-26, Steam Generator D Containment Isolation Valve, movement to its fail-safe (closed) position upon loss of power to the controlling solenoid. The loss of power was caused by a voltage surge that blew fuse BA 11-12 in Terminal Board (TB) 1209. The voltage surge was caused by grounding both legs of Vital Battery EVCD as a result of the replacement of the control board indicator lamp for valve 2VX-33B, Containment Sample Supply Inside Isolation. This event has been assigned a cause of Possible Design, Manufacturing, Construction/Installation Deficiency because of damaged

insulation resulting in a positive leg ground on the solenoid associated with valve 2CF-26. Corrective actions include inspection of surplus solenoids to ensure serviceable condition of the insulation.

END OF ABSTRACT

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EVALUATION:

Background

The main Feedwater (CF) EIIS:SJ! system takes treated Condensate EIIS:SD! System water, heats it further to improve the plants thermal cycle efficiency, and delivers it at the required flowrate, pressure, and temperature to the Steam Generators (SG) EIIS:SG! for makeup. In the event of the loss of adequate feedwater flow to the SGs, sufficient level cannot be maintained and a Reactor EIIS:RCT! Trip will occur.

The Containment isolation valves EIIS:ISV! provide the means of isolating fluid systems that pass through Containment penetrations EIIS:PEN! so as to confine to Containment, any radioactivity that may be released following a design basis event. Isolation of CF flow to each SG is accomplished via SG CF containment isolation valves. These valves will assume their fail-safe position upon loss of power to the respective controlling solenoid EIIS:SOL!.

The containment air return exchange portion of the Containment Air Return Exchange and Hydrogen Skimmer (VX) EIIS:BB! system assures rapid return of air from upper to lower Containment after initial loss of coolant blowdown.

Description Of Event:

On September 25, 1991 at 1450, Unit 2 Reactor Operator (RO) A received an alarm EIIS:ALM! from Vital Battery EIIS:BY! EVCD, Battery EVCD Ground, followed by alarm panel EIIS: PL! 2 AD-4, annunciator EIIS: ANN! C-4, Steam Generator D flow mismatch low CF flow. The RO observed that the CF regulating valve EIIS:FCV! for SG D was in the full open position and that the Containment isolation valve for SG D was closed and 0 percent feed flow was noted. The unit was manually tripped at the direction of the Unit 2 Senior Reactor Operator (SRO) as a conservative action.

The events leading to the unit trip began on the afternoon of September 24, 1991 when the Control Room (CR) EIIS:NA! received intermittent negative leg ground alarms for battery EVCD until approximately 1700 when

the ground was solidly indicated. An emergency work request (WR) 145771 was generated by CR personnel to investigate and repair the cause of the battery EVCD ground. At 0600 on September 25, the annunciator reflash the ground indication. The Operator Aid computer (OAC) EIIS:ID! information indicated that the ground was on the positive leg. Instrumentation and Electrical (IAE) personnel began investigating the cause of the battery ground and had narrowed the source of the ground to the CF regulating, bypass, and Containment isolation valves. The work continued throughout the morning.

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At approximately 1300 on the same date, Performance (PRF) personnel began valve stroke timing tests on several VX valves. During a portion of the test, the PRF technician noticed that the control board EIIS:MCBD! position indicator light EIIS:IL! for valve 2VX-33B, Containment Sample Supply Inside Isolation, Close, was not illuminated. PRF personnel requested RO A to replace the lamp. RO A stated that upon lamp installation, arcing was noted and a battery ground alarm was again received.

At approximately 1450 that afternoon while performing a later step in the stroke timing test, the PRF technician noticed that the control board open indicator light for valve 2VX-33B, Containment Sample Inside Isolation, was not illuminated. He requested CR personnel to replace the lamp. The lamp was replaced by the Shift Supervisor. The Shift Supervisor indicated that he saw no sparking or arcing upon installation of the lamp, but that upon his subsequent investigation, arcing was noted when the lamp was moved back and forth in the socket. Upon lamp installation, a battery ground annunciator reflash alarm was received and the OAC indicated that the ground had changed from the positive leg to the negative leg. At this same time, the positive leg fuse EIIS:FU! BA 11-12 in terminal board (TB) 1209 which provides power to the controlling solenoid for valve 2CF-26 blew. This removed power from the associated trip solenoid, causing valve 2CF-26 to move to its fail-safe closed position. RO A then received alarm "SG D flow mismatch low CF flow" from alarm panel 2AD-4, annunciator C-4. Moments later, the unit was manually tripped at the direction of the Unit 2 SRO.

Conclusion:

This event has been assigned a cause of Possible Design, Manufacturing, Construction/Installation Deficiency due to damaged insulation EIIS:ISL! on the trip solenoid coil for 2CF-26 valve actuator, resulting in the positive leg ground that initiated the event.

The damaged insulation on this solenoid permitted grounding through the solenoid body and is the cause of the positive battery ground noted on the OAC at approximately 0600 on September 25. It is further substantiated by the annunciator reflash and OAC identification of a negative leg ground after installation of the open indicator light for valve 2VX-33B and subsequent blowing of fuse BA 11-12. The insulation in question surrounds the solenoid coil lead. The lead and insulation are fragile due to their small diameter and consequently are subject to physical/environmental damage during maintenance activities; however, an investigation performed by MES personnel was unable to determine the failure mechanism that resulted in the break in the insulation.

The inadvertent grounding of the replacement light for valve 2VX-33B allowed grounding of both legs of battery EVCD and current flow of approximately 13 amps through the positive

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leg fuse (2 amps) of the controlling solenoid. The loss of power to the solenoid caused valve 2CF-26 to assume its fail-safe closed position causing annunciation of alarm "SG D flow mismatch low CF flow" and ultimately the manual Reactor Trip.

A review of the Nuclear Plant Reliability Data System (NPRDS) performed by the Maintenance Engineering Services (MES) group did not identify any similar problems with the solenoids. This event is, however, NPRDS reportable due to insulation failure.

A review of the Operating Experience Program Data Base for 24 months prior to this event identified the following License Event Reports: 369/90-01, 369/90-11, 369/90-32, 369/91-04, and 370/90-08. These involved Reactor Trips with a cause of unknown. None of these, however, involved possible design, manufacturing, construction/installation deficiencies, therefore, this event is not considered recurring.

There were no personnel injuries, radiation overexposures, or uncontrolled releases of radioactive material as a result of this event.

CORRECTIVE ACTIONS:

Immediate: 1) CR personnel manually tripped the Reactor.

Subsequent: 1) Surplus solenoids stored in the warehouse EIIS:MC! were inspected by MES to ensure that the insulation on the leads was not damaged.

2) The controlling maintenance procedure, MP/O/A/7600/79, Feedwater Isolation Valve Hydraulic Pneumatic Actuator Corrective Maintenance was reviewed by MES to ensure adequate precautions have been incorporated involving handling and care of solenoids during maintenance.

Planned: 1) MES will evaluate the feasibility of indicator boot replacement to lessen chances of lamp grounding.

2) MES will evaluate the feasibility of replacement of entire control board indicator assemblies to lessen chance of lamp grounding.

3) MES Management will inform the manufacturer of the problem and request additional information that will assist in the evaluation.

4) All Unit 1 CF solenoids will be inspected for insulation damage by Maintenance during the current outage.

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5) All Unit 2 CF solenoids will be inspected in 2EOC7 for insulation damage.

SAFETY ANALYSIS:

The Reactor Trip was initiated manually by Operations personnel, and the Turbine Generator EIIS:TG! Trip was automatic as a result of the Reactor Trip. This Reactor Trip is bound by the "Loss of Normal Feedwater Flow" event of the McGuire Final Safety Analysis Report (FSAR), Chapter 15, Section 15.2.7. The event described in the FSAR is more limiting because it assumes a complete loss of Main Feedwater. The Auxiliary Feedwater (CA) EIIS:BA! system is assumed to provide decay heat removal capability following an automatic Reactor Trip from Low Low SG water level. The manual Reactor Trip on September 25, 1991 was initiated as a conservative action before the Reactor Protection EIIS:JC! System would have performed an automatic Reactor Trip. The CF system was available after the Reactor Trip and SG water level did not go as low as predicted in the FSAR. Therefore, the transient was less severe than that analyzed in the FSAR. The CA system started automatically as designed and provided necessary additional feedwater flow to all four SGs to assist in returning SG water level to normal.

All primary and secondary system parameters necessary to ensure a safe shutdown were at or approaching no-load conditions 30 minutes after the

trip. The SG power operated relief valves EIIS:RV! did not open and were not challenged. The Reactor Coolant (NC) system EIIS:AB! power operated relief valves and safety relief valves did not open and were not challenged. This Reactor Trip presented no hazard to the integrity of the NC or Main Steam EIIS:SB! system.

The health and safety of the public were not affected by this incident.

ADDITIONAL INFORMATION:

Sequences of Events:

TR - Trip Report
PR - Personnel Recollection
LB - Logbooks (SRO, RO)
ER - Plant Events Recorder
WR - Station Work Request

Date Time Event

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9/24/91 1400 Negative leg ground indication received in the CR.
WR 145771 is generated by CR personnel to investigate the problem. (PR,LB)

9/25/91 0600 Annunciator reflash and OAC alarm indicates the ground has switched from the negative to the positive leg of battery EVCD.(PR)

9/25/91 0830 IAE personnel begin investigation into battery EVCD approx. 1130 ground indication. Ground is narrowed to the CF valves. (PR, WR)

9/25/91 approx. Performance personnel begin the VX valve stroke test. 1300 (PR)

9/25/91 approx. Valve 2VX-33B "close" lamp is replaced, arcing is 1400 noted by RO, and battery ground alarm received. (PR)

9/25/91 approx. Valve 2VX-33B "open" lamp is replaced. (PR)
1450

9/25/91 1450:33 OAC indication of valve 2CF-26 "not open" indicating valve movement in response to blown fuse BA 11-12 which removed power from the controlling solenoid.

(ER)

9/25/91 1450:37 Valve 2CF-26 closed. (ER)

9/25/91 1450:51 Reactor Main Trip Breaker B open. (ER)

9/25/91 1450:51 Reactor Main Trip Breaker A open. (ER)

9/25/91 1538 Four hour notification is made to the NRC due to manual Reactor Trip and auto CA start. (LB)

ATTACHMENT 1 TO 9208310318 PAGE 1 OF 1

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DUKE POWER

August 27, 1992

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station Unit 2
Docket No. 50-370
Licensee Event Report 370/91-10, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 370/91-10, Revision 1, concerning A Unit 2 Reactor Trip. This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

T.C. McMeekin

TLP/bcb

Attachment

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